

1. (Amended) A sol-gel coating material comprising
- (A) an acrylate copolymer solution comprising a reaction product of:
 - a1) at least one (meth)acrylic ester that is substantially free of acid groups,
 - a2) at least one ethylenically unsaturated monomer that carries at least one hydroxyl group per molecule and is substantially free of acid groups, and
 - a3) at least one ethylenically unsaturated monomer that carries per molecule at least one acid group that can be converted into a corresponding acid anion group;
 - (B) a stock varnish comprising a hydrolysis and condensation product of at least one hydrolyzable silane of the general formula I

$$\text{SiR}_4 \quad (\text{I}),$$
 in which the variable R has the following definition:
 R = hydrolyzable groups, hydroxy groups, and nonhydrolyzable groups, with the proviso that at least one hydrolyzable group is present; and
 - (C) an additive solution comprising
 - c1) at least one ethylenically unsaturated compound containing at least one epoxide group,
 - c2) at least one silane having at least one nonhydrolyzable group R that contains at least one epoxide group, and
 - c3) at least one adduct of the at least one silane having at least one nonhydrolyzable group R that contains at least one amino group and at least one cyclic ethylenically unsaturated dicarboxylic anhydride.
2. (Amended) The sol-gel coating material of claim 1, wherein the sol-gel coating material comprises, based on its overall amount, from 5 to 20% by weight of the acrylate copolymer solution, from 40 to 85% by weight of the stock varnish, and from 0.5 to 3% by weight of the additive solution.
3. (Amended) The sol-gel coating material of claim 1, wherein the sol-gel coating material has a solids contents of the acrylate copolymer solution (A), stock varnish (B), and additive solution (C) in a weight ratio of (A) : (B) : (C) of (1 to 10) : (30 to 60) : (1).

4. (Amended) The sol-gel coating material of claim 1, wherein the stock varnish comprises at least one hydrolyzable metal compound of the general formula II



wherein:

M = aluminum, titanium, or zirconium,

R = hydrolyzable groups, hydroxy groups, and non- hydrolyzable groups, with the proviso that at least one hydrolyzable group is present, and

n = 3 or 4.

5. (Amended) The sol-gel coating material of claim 1, wherein the nonhydrolyzable groups R are at least one of alkyl groups; alkenyl groups; alkynyl groups; and aryl groups; and the hydrolyzable groups R are at least one of hydrogen atoms; alkoxy groups; alkoxy-substituted alkoxy groups having from 3 to 20 carbon atoms; acyloxy groups; and alkylcarbonyl groups.
6. (Amended) The sol-gel, coating material of claim 5, wherein the hydrolyzable groups R are at least one of methoxy, ethoxy, n-propoxy, i-propoxy, n-butoxy, sec-butoxy, beta-methoxyethoxy, acetoxy, propionyloxy, and acetyl groups; and the nonhydrolyzable groups R are at least one of methyl, ethyl, propyl, butyl vinyl, 1-propenyl, 2-propenyl, butenyl, acetylenyl, propargyl, phenyl, and naphthyl groups.
7. (Amended) The sol-gel coating material of claim 1, wherein the nonhydrolyzable group R contains at least one functional group.
8. (Amended) The sol-gel coating material of claim 1, wherein the sol-gel coating material is a sol-gel clearcoat material.
9. (Amended) A method comprising applying the sol-gel coating material of claim 1 to a substrate to produce a scratch-resistant sol-gel coating.

10. (Amended) The method of claim 9, wherein the coating is fully cured.
11. (Amended) The method of claim 9, wherein the coating is one of an automotive OEM coating, an automotive refinish coating, an industrial coating, a container coating, a plastic coating, and a furniture coating.
12. (Amended) A process for producing scratch-resistant sol-gel coatings comprising applying and curing the sol-gel coating material of claim 1 on one of a primed substrate, an unprimed substrate, an unprimed substrate comprising a single- or multi-coat paint system, and a primed substrate comprising a single- or multi-coat paint system.
13. (Amended) A process for producing scratch-resistant sol-gel coatings comprising applying and curing a sol-gel coating material on one of an unprimed substrate and a primed substrate, wherein prior to the applying of the sol-gel coating material, at least one of:
- (i1) a single-coat paint system that is at least one of a one-component clearcoat material, a two-component clearcoat material, a multicomponent clearcoat material, a two-component powder clearcoat material, a multicomponent clearcoat material, a two component UV-curable clearcoat material, and a multicomponent UV-curable clearcoat material;
 - (i2) at least one of a multicoat color paint system and a multicoat effect paint system comprising a topmost coat comprising at least one of a one-component clearcoat material, a two-component clearcoat material, a multicomponent clearcoat material, a two component powder clearcoat material, a multicomponent powder clearcoat material, a two component UV-curable clearcoat material, and a multicomponent UV-curable clearcoat material; and
 - (i3) at least one of a single-coat color paint system comprising a two-component solid-color topcoat material and a single-coat effect paint system comprising a two-component solid-color topcoat material;
- is applied and at least partially cured.

14. (Amended) The process of claim 13, wherein the sol-gel coating material comprises

(A) an acrylate copolymer solution comprising a reaction product of:

- a1) at least one (meth)acrylic ester that is substantially free of acid groups,
- a2) at least one ethylenically unsaturated monomer that carries at least one hydroxyl group per molecule and is substantially free of acid groups, and
- a3) at least one ethylenically unsaturated monomer that carries per molecule at least one acid group that can be converted into the corresponding acid anion group;

(B) a stock varnish comprising a hydrolysis and condensation product of at least one hydrolyzable silane of the general formula I



in which the variable R has the following definition:

R = hydrolyzable groups, hydroxy groups, and nonhydrolyzable groups, with the proviso that at least one hydrolyzable group is present; and

(C) an additive solution comprising

- c1) at least one ethylenically unsaturated compound containing at least one epoxide group,
- c2) at least one silane having at least one nonhydrolyzable group R that contains at least one epoxide group, and
- c3) at least one adduct of the at least one silane having at least one nonhydrolyzable group R that contains at least one amino group and at least one cyclic ethylenically unsaturated dicarboxylic anhydride.

15. (Amended) The process of claim 12, wherein the applied sol-gel coating material is cured by exposure to middle-range IR radiation.

16. (Amended) The process of claim 12, wherein the paint system is at least one of an automotive OEM paint system, an automotive refinish paint system, an industrial coating paint system, a container coating paint system, and a furniture coating paint system.

17. (Amended) A sol-gel coating comprising the sol-gel coating material of claim 1.

18. (Amended) A substrate comprising at least one sol-gel coating of claim 17.

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25. (New) The process of claim 24, wherein at least one of:
- a. the hydrolyzable groups R are at least one of methoxy, ethoxy, n-propoxy, i-propoxy, n-butoxy, sec-butoxy, beta-methoxyethoxy, acetoxy, propionyloxy, and acetyl groups; and the nonhydrolyzable groups R are at least one of methyl, ethyl, propyl, butyl vinyl, 1-propenyl, 2-propenyl, butenyl, acetylenyl, propargyl, phenyl, and naphthyl groups; and
 - b. the at least one functional group is at least one of an epoxide group, an amino group, an olefinically unsaturated group, a mercapto group, an isocyanate group, and a reaction product thereof with further reactive compounds.
26. (New) A sol-gel coating produced by the process of claim 24.
27. (New) A substrate comprising at least one sol-gel coating of claim 26.
28. (New) A sol-gel coating produced by the process of claim 12.
29. (New) A substrate comprising at least one sol-gel coating of claim 28.
30. (New) A sol-gel coating produced by the process of claim 13.
31. (New) A substrate comprising at least one sol-gel coating of claim 30.
32. (New) A sol-gel coating produced by the process of claim 14.
33. (New) A substrate comprising at least one sol-gel coating of claim 32.

Version with Markings to Show Changes Made

As is permitted by 37 C.F.R. §1.121(c)(1)(ii), amendments to the claims are shown by an equivalent marking system. Insertions are still shown by underline, and deletions are shown by strikethrough.

1. (Amended) A sol-gel coating material comprising
- (A) an acrylate copolymer solution comprising ~~at least one acrylate copolymer (A1)~~ preparable by copolymerizing at least the following monomers a reaction product of:
- al) at least one (meth)acrylic ester ~~which~~that is substantially free of acid groups,
- a2) at least one ethylenically unsaturated monomer ~~which~~that carries at least one hydroxyl group per molecule and is substantially free of acid groups, and
- a3) at least one ethylenically unsaturated monomer ~~which~~that carries per molecule at least one acid group ~~which~~that can be converted into ~~the a~~ corresponding acid anion group;
- (B) a stock varnish ~~preparable by hydrolyzing and condensing~~comprising a hydrolysis and condensation product of at least one hydrolyzable silane ~~(B1)~~ of the general formula I
- $$\text{SiR}_4 \quad (\text{I}),$$
- in which the variable R has the following definition:
- R = hydrolyzable groups, hydroxy groups, and nonhydrolyzable groups, with the proviso that at least one, ~~preferably at least two~~, hydrolyzable group(s) is ~~or are~~ present; and
- (C) an additive solution comprising
- c1) at least one ethylenically unsaturated compound containing at least one epoxide group,
- c2) at least one silane ~~(B1)~~ having at least one nonhydrolyzable group R ~~which~~that contains at least one epoxide group, and
- c3) at least one adduct of the at least one silane ~~(B1)~~ having at least one nonhydrolyzable group R ~~which~~that contains at least one amino group

and at least one cyclic ethylenically unsaturated dicarboxylic anhydride.

2. (Amended) The sol-gel coating material of claim 1, ~~characterized in that it~~wherein the sol-gel coating material comprises, based ~~in each case~~ on its overall amount, from 5 to 20, ~~preferably from 10 to 15 and in particular from 11 to 14%~~ by weight of the acrylate copolymer solution (A), from 40 to 85, ~~preferably from 45 to 80, and in particular from 50 to 75%~~ by weight of the stock varnish (B), and from 0.5 to 3, ~~preferably from 1 to 2, and in particular from 1.2 to 1.7%~~ by weight of the additive solution (C).
3. (Amended) The sol-gel coating material of claim 1 ~~or 2, characterized in that~~wherein the sol-gel coating material has a solids contents of the constituents acrylate copolymer solution (A), stock varnish (B), and additive solution (C) ~~are~~ in a weight ratio of (A) : (B) : (C) of
—— (1 to 10) : (30 to 60) : (1)
—— preferably 2 to 8 : 35 to 55 : 1, and
—— in particular 2.5 to 6 : 40 to 50 : 1.
4. (Amended) The sol-gel coating material of ~~one of claims 1 to 3, characterized in that~~wherein the stock varnish (B) comprises at least one hydrolyzable metal compound of the general formula II
- $$\text{MR}_n \quad (\text{II}),$$
- ~~in which the variables and the index have the following definition~~wherein:
- M = aluminum, titanium, or zirconium,
R = hydrolyzable groups, hydroxy groups, and non- hydrolyzable groups, with the proviso that at least one, ~~preferably at least two,~~ hydrolyzable group(s) is ~~or are~~ present, and
n = 3 or 4.
5. (Amended) The sol-gel coating material of ~~one of claims 1 to 4, characterized in that~~wherein

——the nonhydrolyzable groups R are at least one of alkyl groups, especially having from 1 to 4 carbon atoms; alkenyl groups, especially having from 2 to 4 carbon atoms; —alkynyl groups especially having from 2 to 4 carbon atoms; and/or aryl groups, especially having from 6 to 10 carbon atoms; and

——the hydrolyzable groups R are at least one of hydrogen atoms; alkoxy groups, especially having from 1 to 20 carbon atoms; alkoxy-substituted alkoxy groups having from 3 to 20 carbon atoms; acyloxy groups, especially having from 1 to 4 carbon atoms; and alkylcarbonyl groups, especially having from 2 to 6 carbon atoms.

6. (Amended) The sol-gel, coating material of claim 5, ~~characterized in that wherein~~
——the hydrolyzable groups R are at least one of methoxy, ethoxy, n-propoxy, i-propoxy, n-butoxy, sec-butoxy, beta-methoxyethoxy, acetoxy, propionyloxy, and/or acetyl groups; and ~~the~~
——the nonhydrolyzable groups R are at least one of methyl, ethyl, propyl, butyl vinyl, 1-propenyl, 2-propenyl, butenyl, acetylenyl, propargyl, phenyl, ~~and/or~~ and naphthyl groups.
7. (Amended) The sol-gel coating material of ~~one of~~ claims 1 to 6, ~~characterized in that wherein~~ the nonhydrolyzable groups R contains at least one functional group, in particular at least one epoxide group, amino group, olefinically unsaturated group, mercapto group, and/or isocyanate group and/or reaction products thereof with further reactive compounds.
8. (Amended) The sol-gel coating material of ~~one of~~ claims 1 to 7, ~~characterized in that wherein~~ the sol-gel coating material is a sol-gel clearcoat material.
9. (Amended) ~~The use of~~ A method comprising applying the sol-gel coating material ~~in accordance with one of claims 1 to 8 to a substrate to produce a scratch-resistant sol-gel coatings, especially for single coat or multicoat paint systems.~~
10. (Amended) ~~The use of the sol-gel coating material~~ method of claim 9, ~~characterized in that wherein~~ the paint systems in question coating are fully cured single coat or multicoat paint systems.

11. (Amended) ~~The use of the sol-gel coating material~~method of claim 9 ~~or 10,~~
~~characterized in that the paint systems are~~wherein the coating is one of an automotive
OEM ~~paint systems~~coating, an automotive refinish ~~paint systems~~coating, an industrial
~~paint systems~~coating, including a container coatings, a plastic coatings ~~on plastics~~, and
a furniture coatings.

12. (Amended) A process for producing scratch-resistant sol-gel coatings
~~by comprising~~ applying and curing the sol-gel coating materials of claim 1 on one of a
primed ~~substrate~~, or an unprimed substrates, ~~or an unprimed substrate comprising a~~
single- or multi-coat paint system, ~~or and a primed substrates comprising a single- or~~
multi-coat paint system ~~provided with a single coat or multicoat paint system,~~
characterized in that a sol-gel coating material in accordance with one of claims 1 to 8
is used in this process.

13. (Amended) A process for producing scratch-resistant sol-gel coatings
~~by comprising~~ applying and curing a sol-gel coating materials on one of an unprimed
substrate ~~or and a primed substrates which have been provided with a single coat or~~
multicoat paint system, characterized in that, wherein prior to the application ~~applying~~
of the sol-gel coating material, at least one of:
 - (i1) a single-coat paint system ~~based on~~that is at least one of a one-component (1K)
clearcoat material, a two-component (2K) clearcoat material, ~~or a~~
multicomponent (3K, 4K) ~~clearcoat material~~, a two-component powder
clearcoat material, a multicomponent clearcoat material, ~~or a two component~~
UV-curable clearcoat material, and a multicomponent UV-curable clearcoat
material;
 - (i2) at least one of a multicoat color ~~and/or effect~~ paint system and a multicoat
effect paint system ~~with comprising~~ a topmost coat ~~based on~~comprising at
least one of a one-component (1K) ~~clearcoat material~~, a two-component (2K)
clearcoat material, ~~or a multicomponent (3K, 4K) clearcoat material~~, a two
component powder clearcoat material, a multicomponent powder clearcoat
material, ~~or a two component UV-curable clearcoat material~~, and a
multicomponent UV-curable clearcoat material; ~~and especially a one-~~

~~component (1K) clearcoat material, two-component (2K) or multicomponent (3K,4K) clearcoat material, or~~

- (i3) at least one of a single-coat color and/or effect paint system comprising a two-component solid-color topcoat material and a single-coat effect paint system based on comprising a two-component (2K)-solid-color topcoat material;
is applied and ~~partly~~at least partially cured.

14. (Amended) The process of claim 13, ~~characterized in that~~wherein ~~the~~ sol-gel coating material ~~comprises in accordance with one of claims 1 to 8 is used in this process.~~

(A) an acrylate copolymer solution comprising a reaction product of:

- a1) at least one (meth)acrylic ester that is substantially free of acid groups,
a2) at least one ethylenically unsaturated monomer that carries at least one hydroxyl group per molecule and is substantially free of acid groups,
and
a3) at least one ethylenically unsaturated monomer that carries per molecule at least one acid group that can be converted into the corresponding acid anion group;

(B) a stock varnish comprising a hydrolysis and condensation product of at least one hydrolyzable silane of the general formula I



in which the variable R has the following definition:

R = hydrolyzable groups, hydroxy groups, and nonhydrolyzable groups,
with the proviso that at least one hydrolyzable group is present; and

(C) an additive solution comprising

- c1) at least one ethylenically unsaturated compound containing at least one epoxide group,
c2) at least one silane having at least one nonhydrolyzable group R that contains at least one epoxide group, and
c3) at least one adduct of the at least one silane having at least one nonhydrolyzable group R that contains at least one amino group and at least one cyclic ethylenically unsaturated dicarboxylic anhydride.

15. (Amended) The process of ~~one of claims 12 to 14, characterized in that~~wherein the applied sol-gel coating material is cured by exposure to middle-range IR radiation.
16. (Amended) The process of ~~one of claims 12 to 15, characterized in that that~~wherein the paint systems ~~are~~is at least one of an automotive OEM paint systems, an automotive refinish paint systems, an industrial coating paint systems, ~~including a~~ container coatings paint system, and a furniture coatings paint system.
17. (Amended) A Ssol-gel coatings ~~which can be produced from comprising the~~ sol-gel coating material ~~in accordance with one of claims 1 to 8 and/or by the process in accordance with one of claims 12 to 16.~~
18. (Amended) A Ssubstrates comprising at least one sol-gel coating ~~in accordance with~~of claim 17.

Please insert the following new claims:

19. (New) The sol-gel coating material of claim 7, wherein the at least one functional group is at least one of an epoxide group, an amino group, an olefinically unsaturated group, a mercapto group, an isocyanate group, and a reaction product of any of the preceding with further reactive compounds.

20. (New) The sol-gel coating material of claim 1, wherein at least two of:

- a. the sol-gel coating material comprises, based on its overall amount, from 5 to 20% by weight of the acrylate copolymer solution, from 40 to 85% by weight of the stock varnish, and from 0.5 to 3% by weight of the additive solution;
- b. the sol-gel coating material has a solids contents of the acrylate copolymer solution (A), stock varnish (B), and additive solution (C) in a weight ratio of (A) : (B) : (C) of (1 to 10) : (30 to 60) : (1);
- c. the stock varnish comprises at least one hydrolyzable metal compound of the general formula II



wherein:

M = aluminum, titanium, or zirconium,

R = hydrolyzable groups, hydroxy groups, and non- hydrolyzable groups, with the proviso that at least one hydrolyzable group is present, and

n = 3 or 4

- d. the nonhydrolyzable groups R are at least one of alkyl groups; alkenyl groups; alkynyl groups; and aryl groups; and the hydrolyzable groups R are at least one of hydrogen atoms; alkoxy groups; alkoxy-substituted alkoxy groups having from 3 to 20 carbon atoms; acyloxy groups; and alkylcarbonyl groups;
- e. the nonhydrolyzable groups R contain at least one functional group; and
- f. the sol-gel coating material is a sol-gel clearcoat material.

21. (New) The sol-gel coating material of claim 20, wherein at least one of:

- a. the hydrolyzable groups R are at least one of methoxy, ethoxy, n-propoxy, i-propoxy, n-butoxy, sec-butoxy, beta-methoxyethoxy, acetoxyl, propionyloxy, and acetyl groups; and the nonhydrolyzable groups R are at least one of

methyl, ethyl, propyl, butyl vinyl, 1-propenyl, 2-propenyl, butenyl, acetylenyl, propargyl, phenyl, and naphthyl groups; and

- b. the at least one functional group is at least one of an epoxide group, an amino group, an olefinically unsaturated group, a mercapto group, an isocyanate group, and a reaction product thereof with further reactive compounds.

22. (New) A sol-gel coating comprising the sol-gel coating material of claim 20.

23. (New) A substrate comprising at least one sol-gel coating of claim 22.

24. (New) The process of claim 14, wherein at least one of:

- a. the sol-gel coating material comprises, based on its overall amount, from 5 to 20% by weight of the acrylate copolymer solution, from 40 to 85% by weight of the stock varnish, and from 0.5 to 3% by weight of the additive solution;
- b. the sol-gel coating material has a solids contents of the acrylate copolymer solution (A), stock varnish (B), and additive solution (C) in a weight ratio of (A) : (B) : (C) of (1 to 10) : (30 to 60) : (1);
- c. the stock varnish comprises at least one hydrolyzable metal compound of the general formula II



wherein:

M = aluminum, titanium, or zirconium,

R = hydrolyzable groups, hydroxy groups, and non- hydrolyzable groups,
with the proviso that at least one hydrolyzable group is present, and

n = 3 or 4

- d. the nonhydrolyzable groups R are at least one of alkyl groups; alkenyl groups; alkynyl groups; and aryl groups; and the hydrolyzable groups R are at least one of hydrogen atoms; alkoxy groups; alkoxy-substituted alkoxy groups having from 3 to 20 carbon atoms; acyloxy groups; and alkylcarbonyl groups;
- e. the nonhydrolyzable groups R contain at least one functional group; and
- f. the sol-gel coating material is a sol-gel clearcoat material.